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PRACTICAL

# ELECTRONICS

JULY 1978

45p



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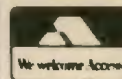


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# PE TV GAME • CENTRE



**T**his is really two separate t.v. games circuits combined in one box to give a selection of stunt motorcycle games and a large variety of ball games too.

The four "bike" games comprise: *Stunt Cycle*, *Drag Race*, *Super Stunt Cycle*, and *Motocross*. These are provided by the AY-3-8760-1 games chip, and occupy the right-hand side of the Game Centre fascia.

There are ten ball games comprising *Solo Target*, *Solo Basketball*, *Solo Squash*, *Tennis*, *Double Target*, *Gridball*, *Soccer*, *Ice Hockey*, *Basketball* and *Squash*.

## STUNT CYCLE SECTION

These are games for one player who controls the speed of a motorbike and rider. At the start of each game, the motorbike and rider are stationary at the upper left-hand side of the TV screen. As the player turns the throttle controller, the motorbike and rider move across the screen on track 1. The motorbike sound starts with the bike movement and as the bike and rider accelerate, the motorbike sound reflects these speed changes. The motorbike wheels have an appearance of rotating at a speed also related to the throttle setting. At the end of track 1, the bike and rider reappear on track 2 at the left-hand side, and likewise at the end of track 2, the bike appears on track 3 at the left-hand side of the screen. Movement of the bike and rider on track 3 over the right-hand edge of the screen causes a reinitialisation of the bike and rider to the left of the screen on track 1. There is no further movement until the throttle is reset to a slow speed and then increased again. The playing field for each game is shown opposite.



## DRAG RACE

The object of this game is to reach the end of track 3 in the shortest time. The three-digit score is automatically reset as the rider first begins to move on track 1 and the score is incremented until the game is over. The score appears centred on the screen above track 1, and remains until the start of the next game.

Drag Race requires a speed shifting to achieve the lowest time scores. As the throttle speed is increased and the rider begins to move, the bike is in speed one and moves at a set rate across the screen. The only way to accelerate the bike motion is to return the throttle to a "slow" position and then return to a "fast" position. This shifting procedure will move the bike into speed 2, which will then go across the screen at a faster rate. Another "shift" will allow speed 3.

A PROFESSIONAL/AMATEUR switch is provided to select a difficulty factor. In the professional mode, a crash occurs if the player tries to increase the throttle speed too rapidly. A crash will flip the bike and rider upside down, and the sound will be a high-pitch screech. At the end of the crash, the bike and rider are reinitialised on track 1, and the score reset. In the easy mode, no crash is allowed.

## MOTOCROSS

As the throttle speed is increased, the bike and rider move across track 1 at a rate determined by the throttle controller setting. Motocross has no speed shifting. Located on each of the three tracks are obstacles. The PRO/AM option switch selects the number of obstacles per track. The easier mode has one obstacle per track and the harder mode has two obstacles per track.

The object of this game is to traverse the three tracks in the shortest time, doing a "wheelie" over each obstacle. The score counters record the run time in the same manner as the Drag Race game.

In Motocross the crash is not caused by accelerating too rapidly. The crash is caused by not doing a "wheelie" over an obstacle. In the "wheelie" position, the bike will have the front wheel lifted off the track. A crash into an obstacle will flip the bike upside down and produce the screech sound. The score resets at the end of the crash.

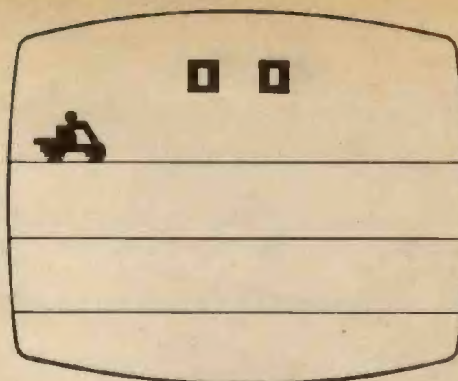
## STUNT CYCLE

The object of this game is to control the throttle speed to properly jump the ramp and buses located on track 3. The game begins with 8 buses and with each successful jump over the ramp and buses, an additional bus appears. The game is over when the maximum number of errors has been reached, which is 3 or 7 errors depending on the position of the PRO/AM switch or when 36 buses have been jumped, in which case the screen will fill up with buses. The game is then started by reselecting the Stunt Cycle game input.

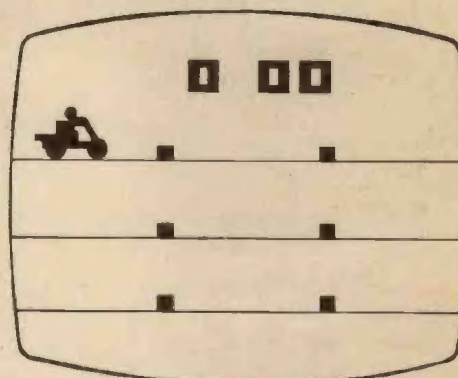
Errors are caused by accelerating too rapidly, insufficient speed to clear the buses, or landing too far past the back ramp after the jump. The bike and rider flip upside down and a screeching sound indicates an error. The score records the number of errors in the first digit and the number of displayed buses in the next two digits.

## SUPER STUNT CYCLE

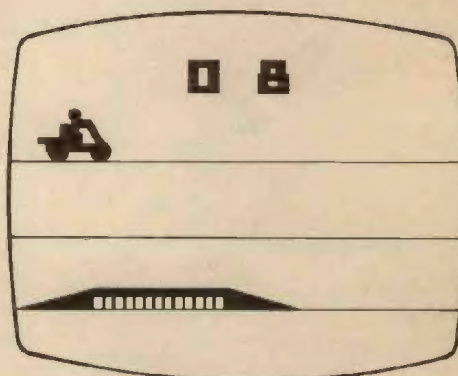
This game is similar to Stunt Cycle with the addition of obstacles on track 1 and track 2. The object is to do a "wheelie" over each obstacle and then adjust the throttle for the correct speed to jump the buses on track 3. The PRO/AM option switch selects 2 obstacles per track and allows 3 errors per game in the harder mode, and 1 obstacle per track and 7 errors per game in the easy mode. Errors are



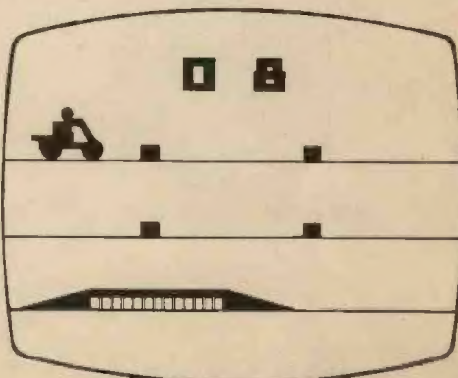
DRAG RACE



MOTOCROSS



STUNT CYCLE



SUPER STUNT



caused by accelerating too rapidly, not being in the "wheelie" position over the obstacles, insufficient speed to clear the buses, or landing too far past the back ramp after the jump. The score records the number of errors and the number of buses displayed, the same as in the game of Stunt Cycle.

### BALL AND PADDLE SECTION

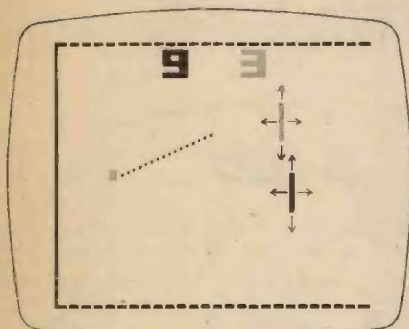
In all games, the ball starts at slow speed. If the high speed mode has been selected the ball will switch to high speed after seven consecutive hits by the players without a goal being scored.

The bats are segmented into five zones, each zone defining

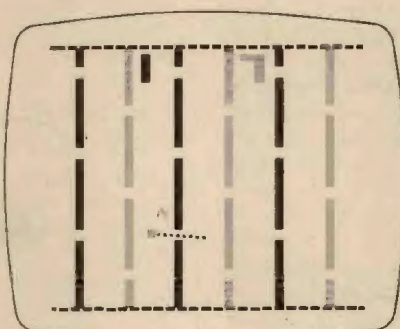
a different rebound angle. The zones listed from top of bat to bottom are nominally 40° up, 20° up, horizontal, 20° down, 40° down. A ball passing through a bat from behind will have its angle influenced as above, but not its left/right direction.

All two player games terminate when one player has 15 points at which time the score flashes and the bats have no further effect on the ball.

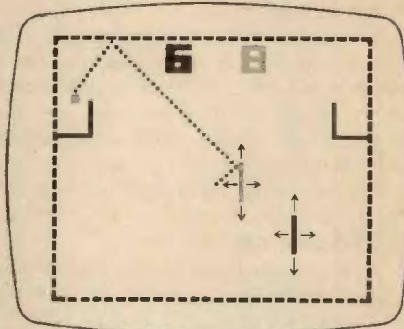
A tone of approximately 500Hz, 1kHz and 2kHz will be generated for a nominal period of 32ms for "ball hits wall", "ball hits bat" and "score". The output is capable of direct driving a 100Ω speaker.



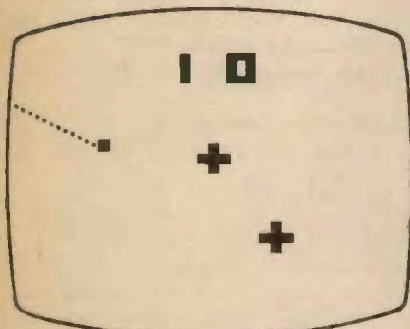
SQUASH



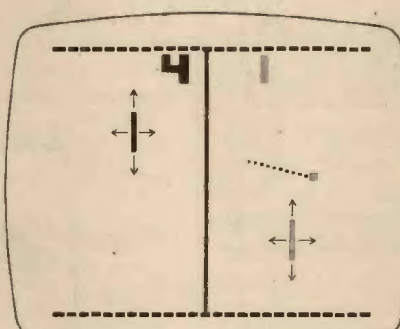
GRIDBALL



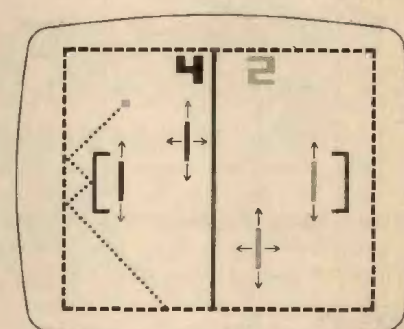
BASKETBALL



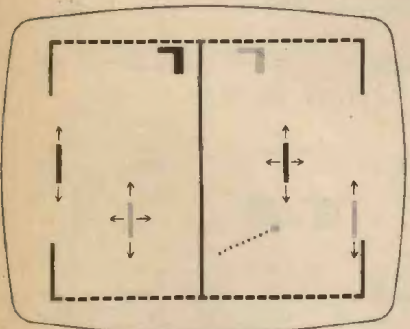
TARGET



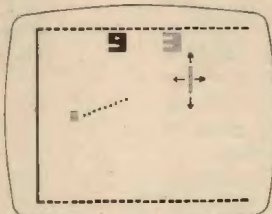
TENNIS



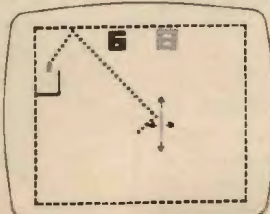
ICE HOCKEY



SOCCER

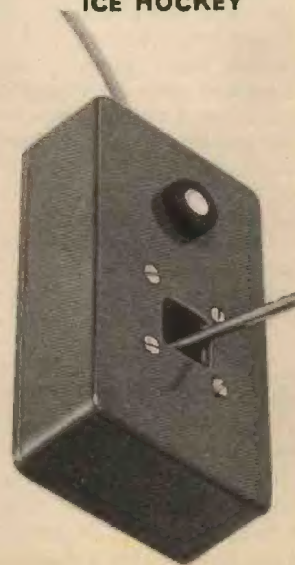


SOLO SQUASH



SOLO BASKETBALL

### BALL GAMES





## SQUASH

This game uses the playing area shown opposite. Each player can move over the whole court. The game will start when the player whose service it is, depresses his SERVICE button. The ball moves off with a random angle towards the front wall. The colour of the ball will change to the colour code of the next player to hit the ball. Should the wrong player intercept or be hit by the ball it will be considered a fault. Points will only be given if won on player's own service. Points won on opponent's service will only cause a service change.

## SOLO SQUASH

This game is for a single player. The right score counts the number of successive hits in the current game (to a maximum of 15), the left score the number of volleys played.

## GRIDBALL

This is a game of considerable mental agility. Each player has three sets of vertically moving barriers to block the ball from approaching his end of the field, and openings in the barriers to permit the ball to advance towards the opponent's end. The game starts when both players have depressed their SERVICE buttons. The ball moves away from the face off point with a random angle in either direction.

## BASKETBALL

The basketball games use the closed playing area shown. Participant players must deflect the ball and cause it to enter the top of the goal to score. The game starts when both players depress their SERVICE buttons simultaneously. The ball moves from the service point with a random angle in either direction.

## SOLO BASKETBALL

Basketball practice is a one player game which utilises only the left basket (see opposite). The right counter displays the number of hits the player makes without scoring while the left counter shows the number of baskets made. Play starts when the right SERVICE button is depressed.

## TARGET

In the double game each player has a cross which he can move to any point on the screen. From the edge of the field will come moving targets one at a time, and a player must position his cross over the target and simultaneously push the SERVE button to get a hit. Moving the cross towards the origin of the moving target will give a player the chance to beat his opponent to a score, but will also give him less thinking time in which to react when the target flies out. All scores are shown at the top of the screen.

Only one cross appears for the single player version of this game.

## TENNIS

The game uses the playing area shown (opposite). Each player can only move around his side of the court. The game will start when the player whose turn it is to serve, pushes his SERVICE button. The service will automatically change every five points scored. At service the ball will move away from the service point with a random angle but always towards the net.

## HOCKEY

Forwards on both sides have freedom to move over the entire playing area. The goal keepers will be locked in the horizontal axis in front of their respective goals, but will move in the vertical axis in the same manner as the forwards.

The game starts when both players have depressed their SERVICE buttons. The ball will move away from the face-off point with a randomly selected angle in either direction.

## SOCCER

Motion of the players is as in the hockey game. The game will start when the loser of the previous goal depresses his SERVICE button. The ball will move away from the kick-off point with a randomly selected angle but always towards the goal of the winner of the previous goal.

## CIRCUIT DESCRIPTION

No simple description can be given for the extensive internal workings of the two I.s.i. games chips, and most of the remaining electronics fall into two categories: game selection and t.v. interfacing, so that the games unit may be plugged directly into the t.v. aerial socket. See Fig. 1.

Because there are two games chips, a system is necessary to switch from one to the other and this is the function of IC9. The ball and paddle games are selected on IC1 by momentarily connecting certain combinations of Strobe (STR) and select (SEL) lines, but when any of these selection switches (S1-8, S10, S11) are pushed, generating a low input to the IC10(a) NAND gate, the output IC10(a) pin 13 goes high which will reset the D-type flip-flop IC9(a.) By the same mechanism IC9(a) can be set via IC10(b) when a motorcycle game is selected.

The Q and  $\bar{Q}$  outputs from the flip-flop are used to control the 6.5V power supply lines to both games i.c.s, thus shutting down the one not in use.

## POWER SUPPLY

The d.c. input enters via a miniature jack socket, and is generated by an external mains power pack which plugs directly into a 13A socket. The Zener stabiliser comprising TR3 and D11, etc. produces 6.5V to supply the unit. Both games i.c.s are motivated by a clock signal which is provided by the oscillator designed around TR4.

## COLOUR ENCODER UNITS

As can be seen in Fig. 1, the colour encoder has four inputs: yellow, blue, green and red. The bus carrying the video outputs from IC1 can be identified, and these are ORED at IC7 with the video outputs from IC2. This is arranged so that whichever games chip is in use, the colour encoder will receive the necessary signals. It is in this "colour bus" that the colour system departs from a black and white system, where a composite signal only is generated. In this game, the right video output (for right player) is fed to the blue input, and likewise the left video goes to yellow. The players' bats then comply with this colour coding. Some diode OR signal processing is also necessary, and can be seen around IC5. A composite signal is generated, and the cycle games composite signal is produced by the summing amplifier TR5. The ball games signals are similarly summated at amplifier TR6. These two composite signals are then ORED by means of the mutual emitters of TR5 and TR6, and fed to the composite video input of the modulator system.



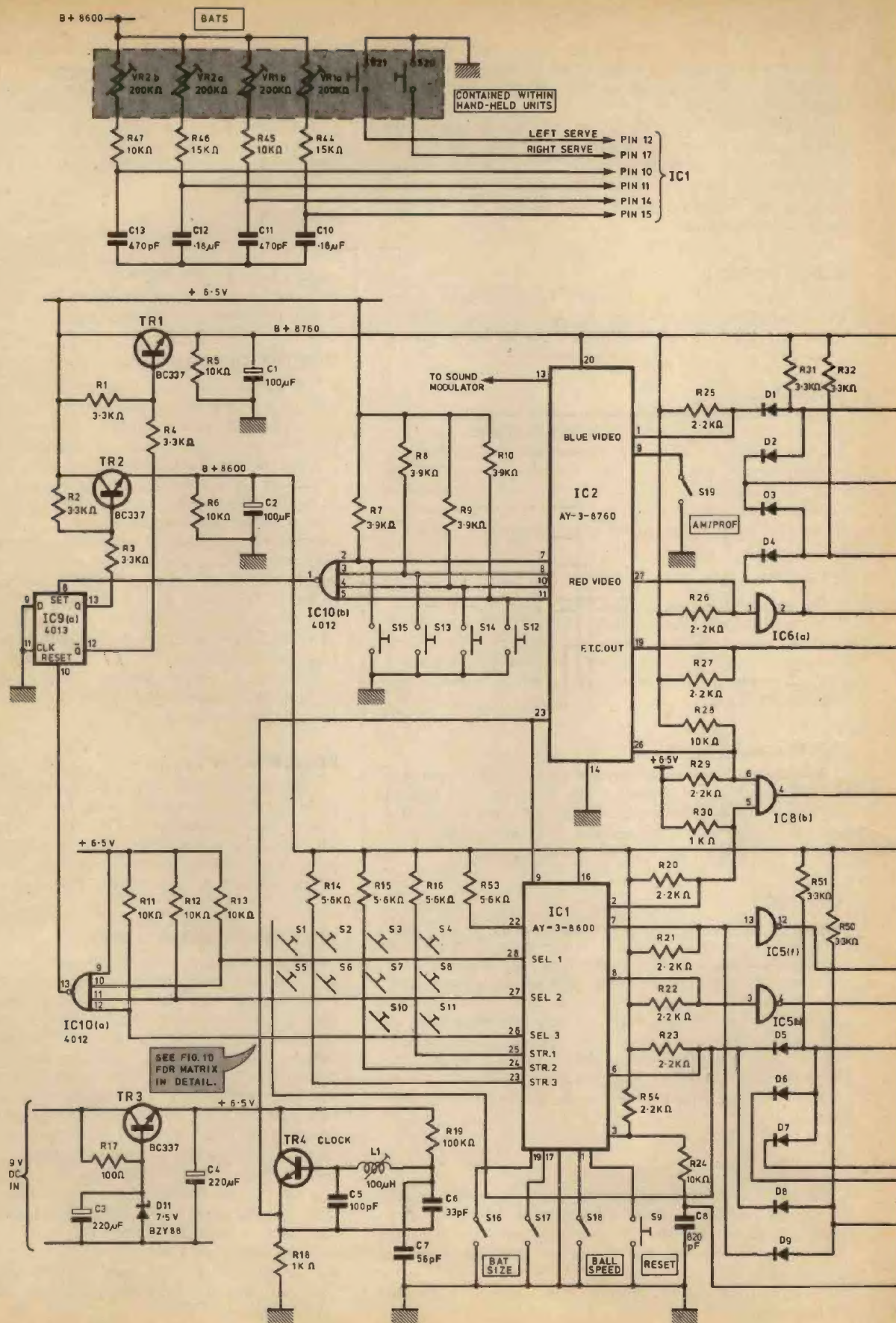
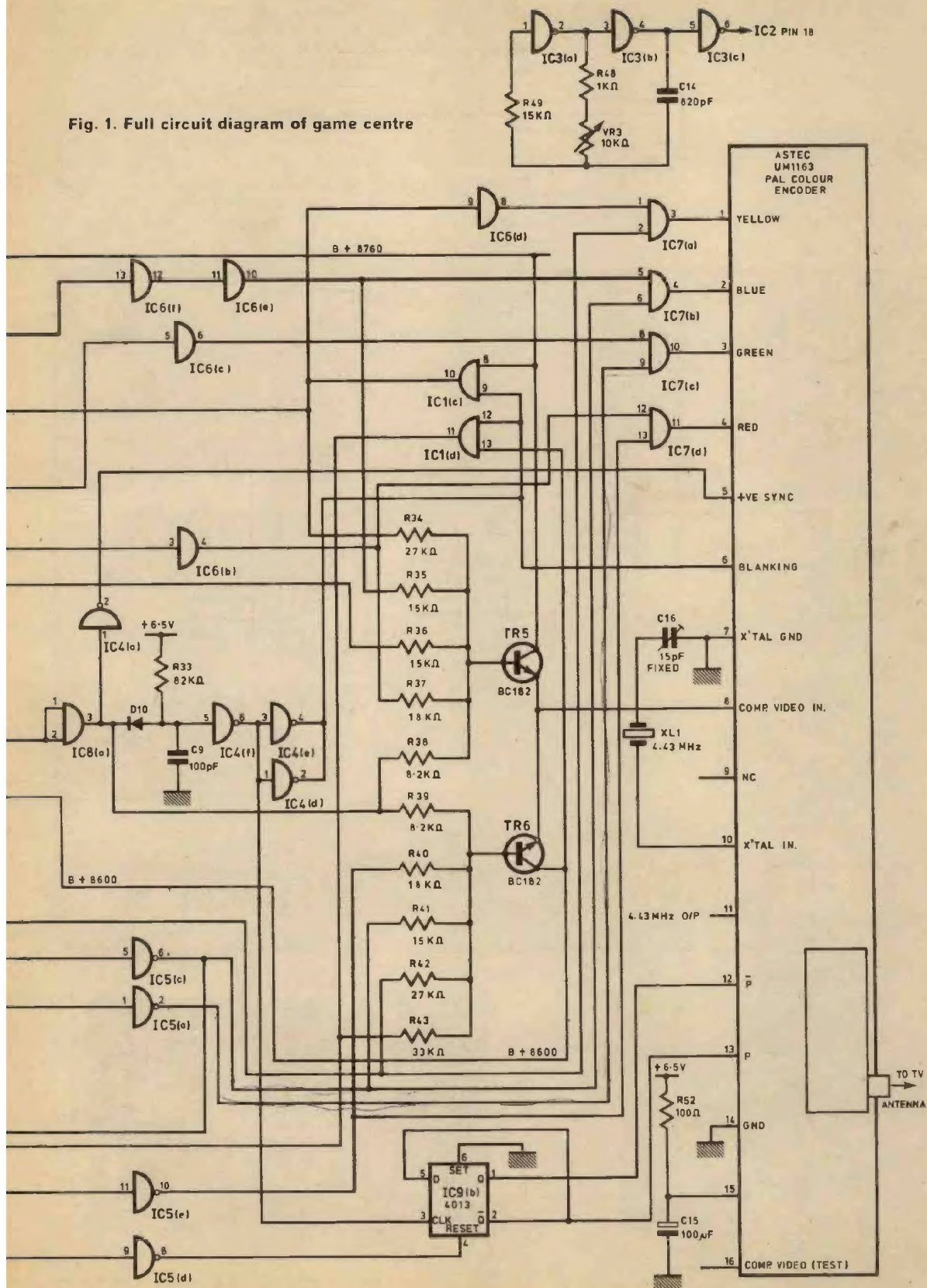




Fig. 1. Full circuit diagram of game centre





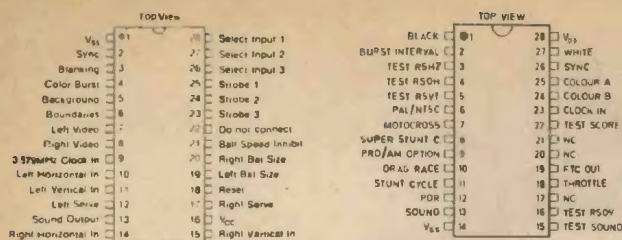


Fig. 2. Pinouts for games i.c.s.  
(a) AY-3-8600 (b) AY-3-8760

## COMPONENTS . . .

### Resistors

R1-R4, R31, R32, R50, R51	3.3k $\Omega$ (8 off)
R5, R6, R11-R13, R24, R28, R45, R47	10k $\Omega$ (9 off)
R7-R10	3.9k $\Omega$ (4 off)
R14-R16	5.6k $\Omega$ (3 off)
R17, R30, R48, R18	1k $\Omega$ (4 off)
R52	100 $\Omega$ (1 off)
R19	100k $\Omega$ (1 off)
R20-R23, R25-27, R29	2.2k $\Omega$ (8 off)
R33	8.2k $\Omega$ (1 off)
R34, R42	27k $\Omega$ (2 off)
R35, R36, R41, R49, R44, R46	15k $\Omega$ (6 off)
R37, R40	18k $\Omega$ (2 off)
R43	33k $\Omega$ (1 off)

All resistors  $\frac{1}{4}$ W 5%

### Potentiometers

VR1	200k $\Omega$ lin carbon (dual axis)
VR2	200k $\Omega$ lin carbon (dual axis)
VR3	10k $\Omega$ lin carbon

### Capacitors

C1, C2	100 $\mu$ F/6.3V (2 off)
C3, C4	220 $\mu$ F/10V (2 off)
C5	100pF silvered mica (1 off)
C6	33pF silvered mica (1 off)
C7	56pF silvered mica (1 off)
C8, C14	820pF silvered mica (2 off)
C9	100pF silvered mica (1 off)
C10, C12	0.8 $\mu$ F Mullard C280 (2 off)
C11, C13	470pF silvered mica (2 off)
C15	100 $\mu$ F/6.3V (1 off)
C16	10-40pF trimmer (1 off)

### Transistors and Diodes

TR1-TR3	BC357 (3 off)
TR4-TR6	BC182 (3 off)
D1-D10	Silicon signal diode (10 off)
D11	BZY88 8V2 (1 off)

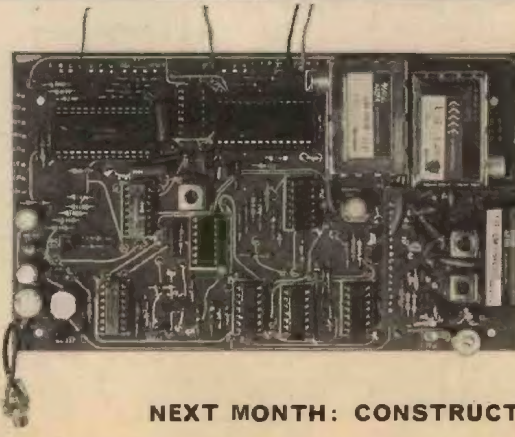
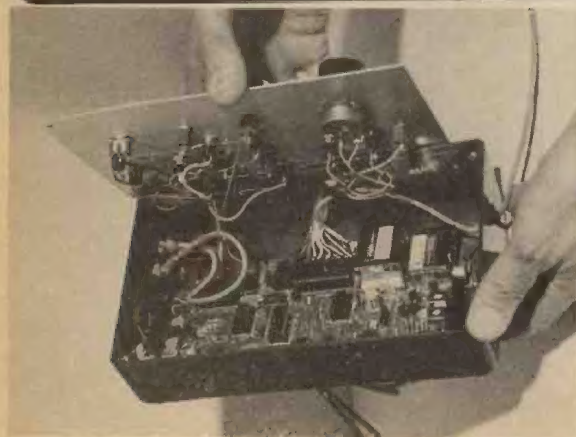
### Integrated Circuits and Modules

IC1	AY-3-8600 (1 off)
IC2	AY-3-8760-1 (1 off)
IC3-IC6	CD4069B (hex inverter) (4 off)
IC7	CD4071B (quad OR) (1 off)
IC8	4081B (1 off)
IC9	4013A (dual D/) (1 off)
IC10	4012B (quad NAND) (1 off)

### Miscellaneous

Module 1	UM1263 sound modulator (Astec)
Module 2	UM1163E36 vision modulator (Astec)
Module 3	UM1164E36 sub-assembly
L1	100 $\mu$ H tunable choke (screened)
XL1	4.4336MHz crystal
	28-pin i.c. socket (2 off)
	14-pin i.c. socket (8 off)
	Plastics boxes for hand held units, 113 x 63 x 30mm (2 off)
	Plastics box for main unit, 215 x 130 x 70mm sloped (1 off)
	Push-to-make switches for S1-S15, S19, S20 (17 off)
	Single-pole, single-throw toggle switches for S16-S19 (4 off)
	Knob for "throttle" control. Mains power pack (V)
	Low loss coaxial cable and TV aerial plug
	4-way screened cable for hand held units
	Printed circuit board

All components are available from Teleplay



NEXT MONTH: CONSTRUCTION





*four motorcycle games*

*ten ball games*

*see last month's P.E.  
for how to play them*

## Part 2

# PE TV GAME CENTRE

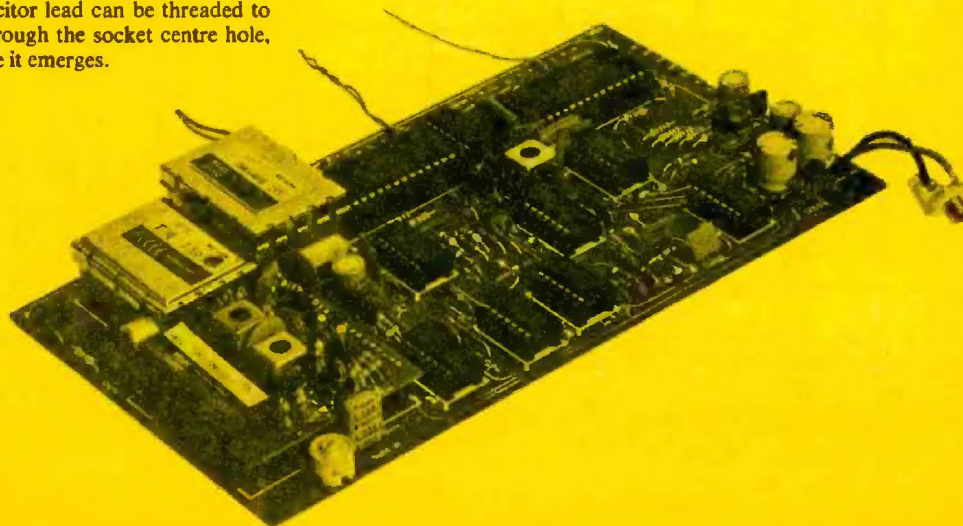
### CONSTRUCTION

Mount all the switches and the potentiometer on the front panel and wire them up as shown in Fig. 2.1, using ribbon cable but leaving the p.c.b. end of the ribbon unconnected.

Insert the i.c.s lastly when assembling the p.c.b., removing them from the conductive foam packing only at the moment necessary. The games chips themselves (IC1 and IC2) should be inserted last of all. Some earthed tin foil laid out on the worktop surface will help to reduce the possibility of damage due to static electricity. It would be advisable to mount the modules early on so that the remaining component space is more apparent. On the UM1263 (sound modulator) it is necessary to remove the lid and solder a 100pF capacitor (C5) between the coaxial socket centre-pin and the p.c.b. The capacitor lead can be threaded to the inside of the modulator box through the socket centre hole, and then soldered at the point where it emerges.

*board powered from  
external power pack*

*minimal  
setting-up  
procedure*





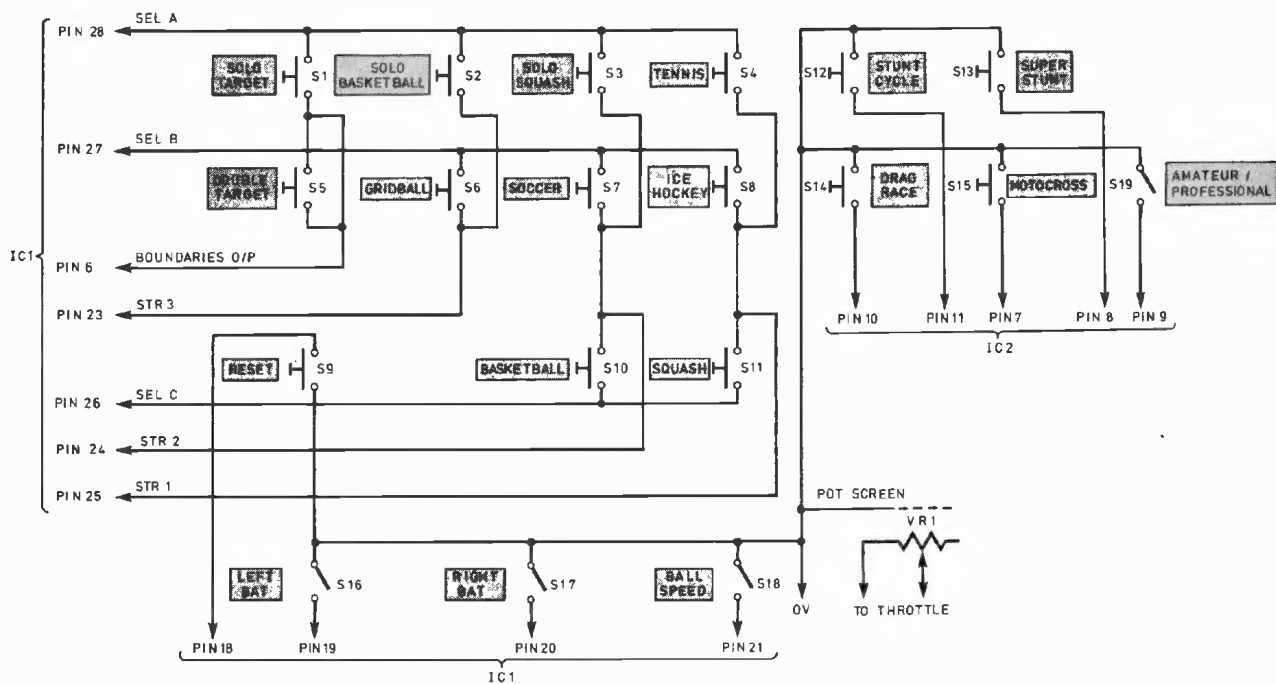
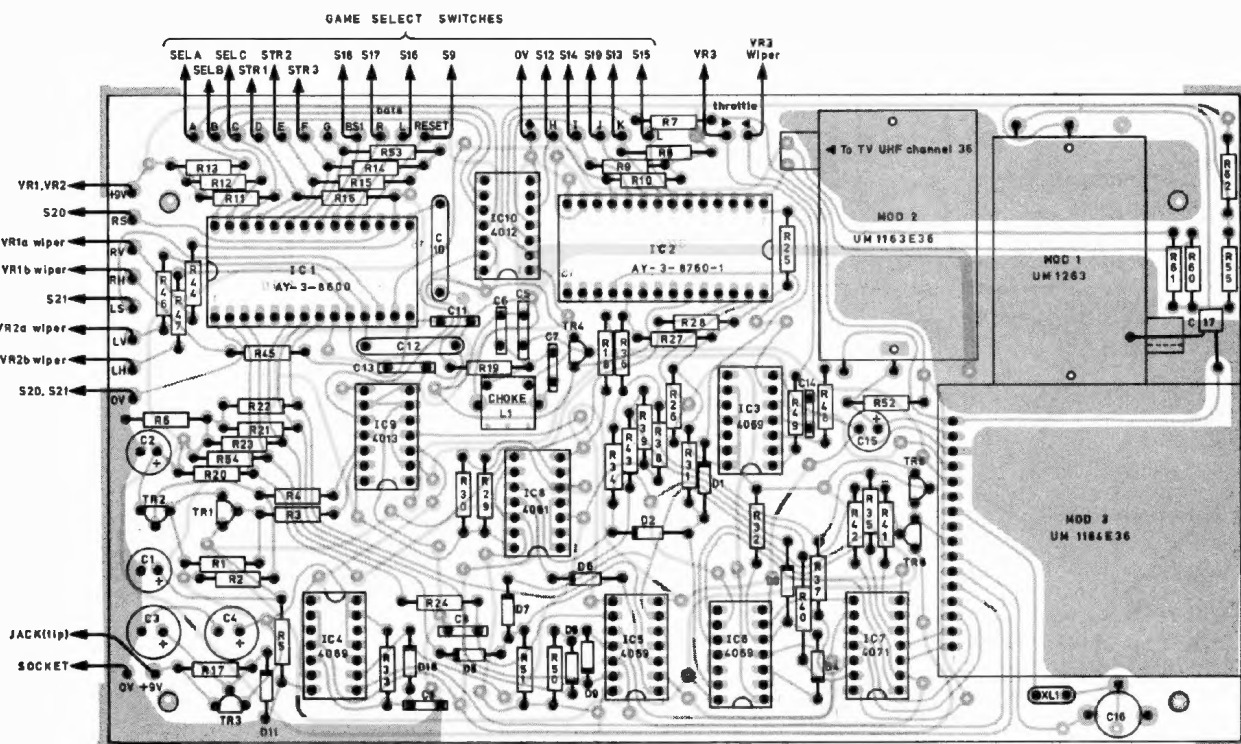


Fig. 2.1. Switch panel wiring diagram. This matrix wiring system was referred to in Part 1, Fig. 1 (wrongly as Fig. 10)

Fig. 2.2. Component board layout. Note that C17 couples the Sound Modulator output socket to the p.c.b.





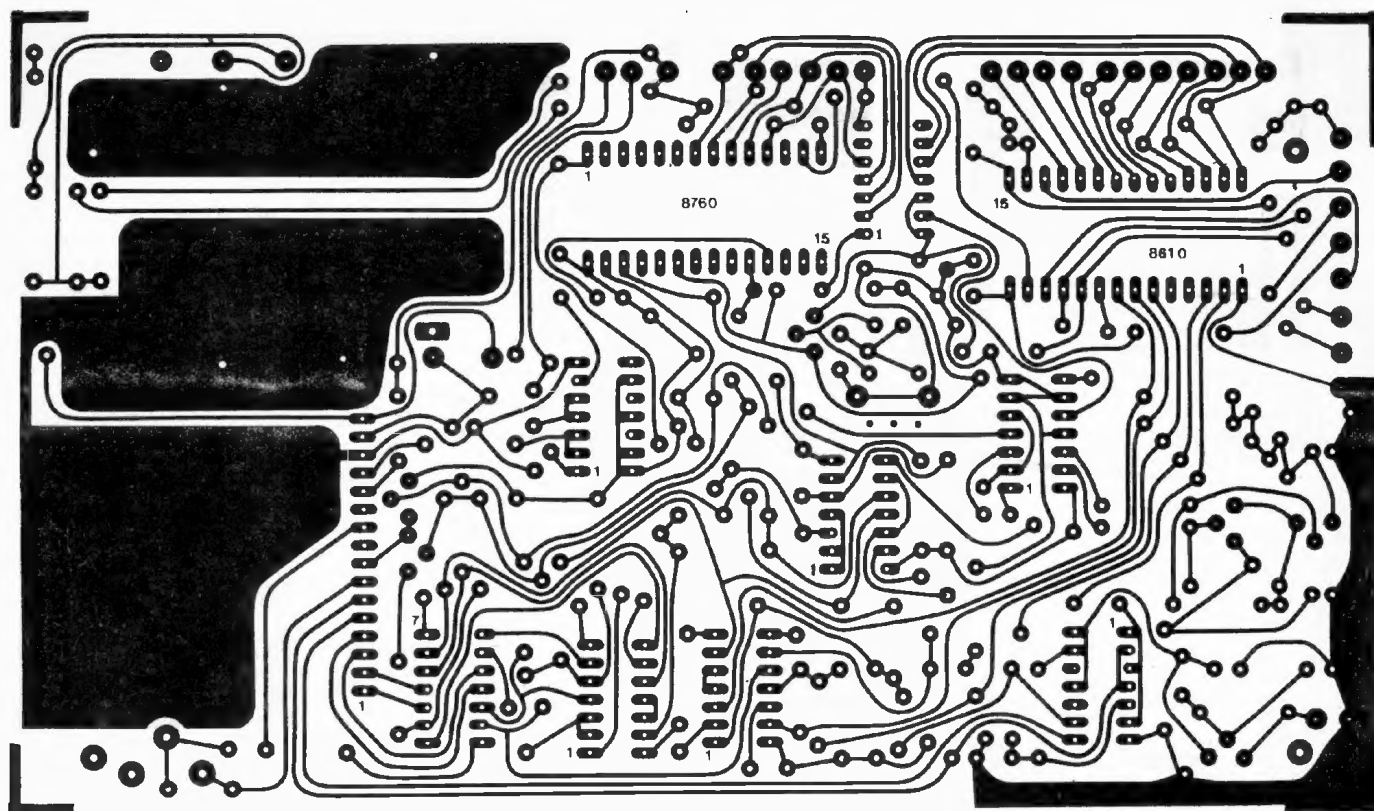
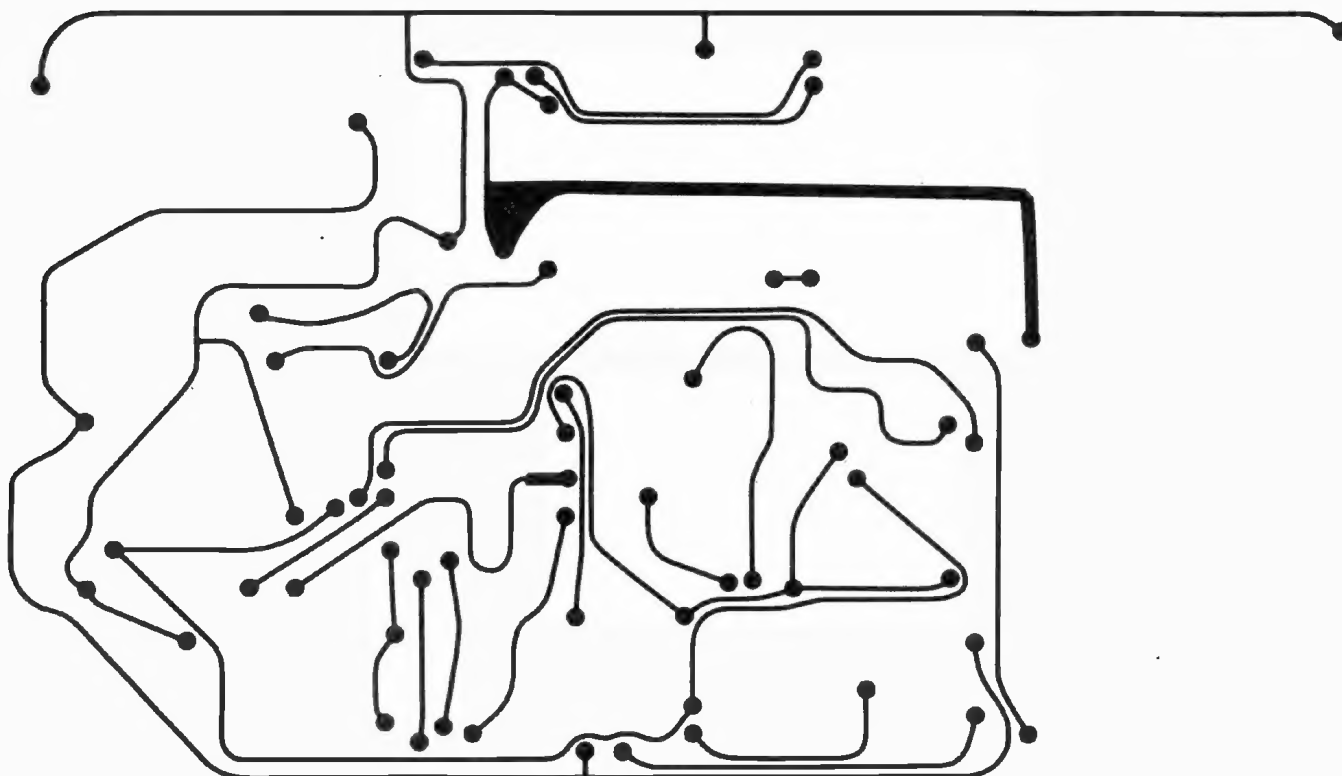
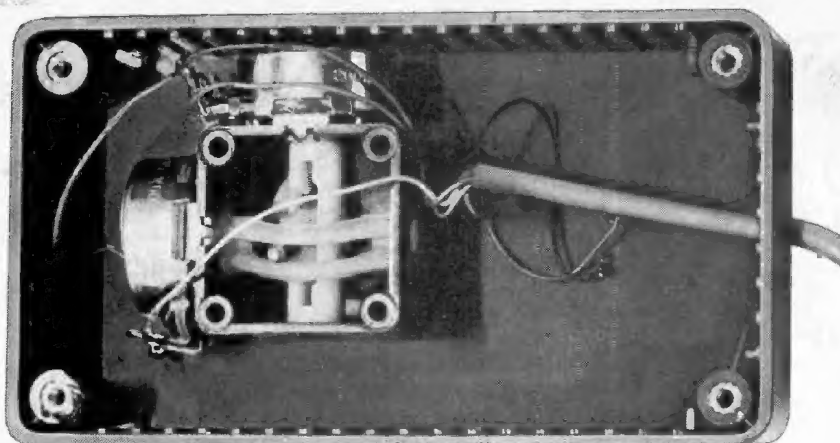


Fig. 2.3. Printed circuit layout (actual size)

Fig. 2.4. Component side p.c.b. (actual size)







The hand-held units (shown here with lid removed), contain dual-axis potentiometers for movement of the bat both up and down, and left and right across the television



The serve buttons supplied by Teleplay are mounted on the outside surface of the box, with only the connection tags passing through the lid

#### CORRECTIONS TO PART ONE

In part one, capacitors C10 and C12 were marked in the components list as 0.8 $\mu$ F. This should read 0.18 $\mu$ F.

TR1-TR3 are BC337 transistors, and the tunable choke should be 40 $\mu$ H R17 is 100 $\Omega$  and *not* 1K $\Omega$ .

It is also necessary to add the following resistors to the components list:

R38, R39	8.2K $\Omega$
R53	5.6K $\Omega$
R54	2.2K $\Omega$
R55	222K $\Omega$
R60, R61	6.8K $\Omega$
R62	100 $\Omega$
C17	100pF silvered mica

The main box should be cut for cable entry holes, and for the miniature jack socket (d.c. supply input). The hand-held units require a square hole of 15 x 15mm to accommodate the dual axis controls, in addition to further drillings for the push buttons and cable entry.

Screened 5-way cable is necessary to connect the hand-held units to the main box, and the wiring of these can be seen in the main circuit diagram.

Once all the switches and potentiometers are mounted and wired up, the p.c.b. can be fixed into the main box using self-tap screws, and then wired to the various controls. Low loss coaxial lead should be used for the aerial input signal to the television set, the other end of which is connected to the UM1163E36 vision modulator coaxial output socket.

The system is now ready to check out, but first look over the p.c.b. and wiring for possible dry joints, and ensure that all diodes and electrolytic capacitors are connected in the right polarity.

#### SETTING-UP

All modules supplied by Teleplay should be pre-tuned, but it may be necessary to adjust the oscillator frequency using L1, to lock the picture onto the screen. This should be done with the unit powered up and the television tuned to Channel 36. Fine tuning of the PAL colour encoder crystal is achieved by trimming XL1 (4.4336MHz).

The unit is powered by a mains adaptor unit which plugs straight into a 13A socket, and jacks into the Game Centre via a low tension lead (jack tip + Ve).

